"Stop writers from writing, in the span that needs to be hidden from future."

- Mrs. Om Lata Singh

Hand Book
of

MICROCONTROLLERS FOR EMBEDDED SYSTEMS

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ISBN-13: 978-93-86258-91-5
FIRST EDITION, FEBRUARY 2018, INDIA

Printed & Published by:
VSRD Academic Publishing
A Division of Visual Soft India Private Limited

Printed & Bound in India

VSRD ACADEMIC PUBLISHING
A Division of Visual Soft (India) Pvt. Ltd.

REGISTERED OFFICE
154, Tezabmill Campus, Anwarganj, KANPUR – 208 003 (UP) (INDIA)
Mob.: +91 9956127040 ||Web.: www.vsrdpublishing.com || Email: vsrdpublishing@gmail.com

MARKETING OFFICE
340, First Floor, Adarsh Nagar, Oshiwara, Andheri(W), MUMBAI – 400 053 (MH) (INDIA)
Mob.: +91 9956127040 || Web.: www.vsrdpublishing.com || Email: vsrdpublishing@gmail.com

PREFACE

जेहि विधि होई नाथ हित मोरा,
करो सुवेगि दास मह तोरा…

"Handbook of Microcontrollers for Embedded Systems" is an attempt to segregate the basics of microcontrollers starting with 8051 and introducing the MSP430x5xx microcontroller series which is latest from Texas Instruments. Texas gives a wide range of microcontroller platforms and based on applications, one can select among them like: MSP430 series, Tiva Series for practical purpose and G series for laboratory demonstrations in colleges. The various packages available can be used with the platforms like:

(1) CC100L Air module booster pack
(2) TI Spin motors DRV8x Evaluation kit.
(3) CC3200 Launch pad
(4) MSP430eZ430-RF2500 Development tool.
(5) Capacitive Touch booster pack
(6) Sensor Hub booster pack with Wireless RFEM connections.
(7) Tiva C Series TM4C123G Launch Pad.
(8) TI's Simple Link CC3100 Booster Pack
(9) C2200 Piccolo Launch Pad etc.

This book is an attempt to give an start up with the Intel's 8051 and has many programming examples in assembly as well as C language which are simulated on Keil µVision 4 using Flash Magic for the kits available in laboratories of M.I.E.T., Meerut.

After the startup, there is a transition to the introduction of MSP430 from Texas Instruments. To give more insight of the same, the datasheets and user manuals have been referred. MSP430 has a rich set of registers to be programmed and therefore one might need the user manual hence every register and its related fields have been discussed. To spare students from referring huge datasheets and user manuals, several programs have been discussed along with registers and their respective fields that need to be programmed.

Alone microcontrollers can't do anything so various interfacing devices like ADC, DAC, stepper motor, external memories, LCD etc have been introduced with Intel's 8051 along with their interfacing and programming.

MSP430 family has various peripherals on boards, so the programming to access them is also discussed along with external interfacing using SPI, I2C and UART communication modules. Case study related to RFID and PIR sensors will give an insight on interfacing external peripherals.

From practical point of views two laboratory solved exercises have also been incorporated in the end along with a dedicated chapter for programming tips of C programming. Chapter 0 comprises of the introduction of software used for both Intel (Keil µVision 4 and Flash Magic) and Texas Microcontrollers (CCS, Teraterm and Energia).

Owing to increasing requirement to access entire sensor networks mainly WSN (Wireless Sensor Networks) through internet, last chapter is compiled to give a insight about IoT and its related WSN, connectivity and interfacings. At the end some sample questions have been incorporated to be practiced.

The compilers of the book recommend readers to refer Mazidi for Intel and John Davies for MSP430 basic information. This book is an effort to gather information available in datasheets, user manuals, books, and blogs etc. Kindly look out for the references for any additional information or you may write to us for any suggestions.

Also it is recommended that readers should refer to the latest edition of the book because there will be new case studies added in updated editions.

✍ *Mohini Preetam Singh*

ACKNOWLEDGEMENT

We are thankful to god and our families for keeping up with us during this period and provide us moral support.

We would also like to thank **Dr. Mayank Garg**, Executive Director, M.I.E.T., Meerut and **Dr. (Professor) D. K. Sharma**, Dean Academics, M.I.E.T., Meerut for their constant support and guidance throughout the endeavors.

We would also like to thank our guides and faculties with whose blessings we are able to reach wherever we are today.

Last but not the least we would also like to thank our students for their constant curiosity that let us work even harder.

✍ *Mohini Preetam Singh*

✍ *Vishal Verma*

✍ *Dr. Vivek Gupta*

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